

**ELECTRONIC EAR PLUG FOR PROVIDING A PROGRAMMABLE  
AUDIBLE ALARM AND METHOD THEREOF**

**Cross-Reference to Related Application**

This non-provisional patent application claims priority under 35 USC § 119(e) to U.S. provisional patent application, Serial No. 60/415,708, filed October 2, 2002, the disclosure of which is incorporated by reference.

**Field of the Invention**

The present invention relates in general to electronic ear plug and, in particular, to An electronic ear plug for providing a programmable audible alarm and method thereof.

**Background of the Invention**

Ear plugs are soft plugs that are inserted into the outer ear canal to block sound and environmental noise. Conventional ear plugs are available in various shapes. Rounded ear plugs fit directly into the outer ear canal and are most effective at noise blocking. Rounded ear plugs are also less prone to falling out of the ear due to movement. Conformable ear plugs generally fit into the cavum conchae of the outer ear to provide a less intrusive form of hearing protection. However, conformable ear plugs are also more apt to fall out if not well-fitted to a particular user's outer ear contours.

Ear plugs are frequently used by people who must sleep in a noisy environment. For example, ear plugs are often used by airplane and train passengers traveling on long trips, sometimes overnight, and who want to sleep to either pass the time or due to an upcoming busy schedule at their destination. Ear plugs are also used by people whose sleep is disturbed each night by ambient noise or a snoring spouse. Ear plugs are also useful to assist concentration of people working in a noisy environment.

Commonly, people who wear ear plugs while sleeping need to wake up at a certain time and would prefer to use an alarm clock to wake on time. However, the ear plugs can block an alarm clock sound, thereby rendering alarm clock usage meaningless. Moreover, an alarm clock with an alarm loud enough to penetrate  
5 through the ear plugs is not always practical. For instance, on an airplane or train, a loud alarm clock could disturb other passengers, while at home, a loud alarm clock could unnecessarily wake up the user's spouse. Similarly, placing an alarm clock close to a user's ear can be inconvenient, as the user could move away from the alarm clock while sleeping, or impractical, such as on an airplane where  
10 physically attaching an alarm clock to a seat could be prohibited.

In the prior art, a personal audible alarm is described in U.S. Patent No. 6,067,006 to O'Brien, issued May 23, 2000, the disclosure of which is incorporated by reference. An audible alarm is placed in an ear plug or hearing protection device. An audio output is located on a side of the earplug open to or  
15 exposed to the user's ear canal. The ear plug includes a battery, clock display, time set switch, alarm set switch, hour set switch, and minute set switch for indicating time of day and alarm time. However, the O'Brien device lacks provisions for external battery recharging and alarm programming and cannot receive downloadable audible alarm tones.

20 Accordingly, there is a need for an approach to embedding a programmable alarm feature directly into an ear plug.

### **Summary of the Invention**

An electronic ear plug for providing a programmable audible alarm and method thereof is described. The electronic ear plugs can be used singly or in  
25 pairs. Operationally, to use the electronic ear plugs, a user first places the electronic ear plugs in a carrying case and uses a keypad to program timer values. After setting a wakeup or alert time, the user places electronic ear plugs in one or both ears. The electronic ear plugs sound an alarm at the programmed time.

An embodiment provides an electronic ear plug for providing a  
30 programmable audible alarm. An audible alarm circuit includes an interface and a countdown timer. The interface receives and stores a user-settable time interval

and at least one programmable alarm tone from an external source into a memory. The countdown timer commences timing upon activation of the user-settable time interval and generates at least one programmable alarm tone responsive to an expiry of the user-settable time interval. An ear plug is shaped on a distal end to be received by an ear and defines a recess on a proximal end housing the audible alarm circuit.

A further embodiment provides a programmable ear plug providing an audible alarm. A removable ear plug is shaped on a distal end to be received by an ear and integrates an audible alarm circuit on a proximal end. A memory maintains a user-settable time interval and at least one programmable alarm tone, which are received over a programming channel. A countdown timer commences timing upon activation of the user-settable time interval and generates the at least one programmable alarm tone responsive to an expiry of the user-settable time interval. A power supply provides power to the memory and the countdown timer and includes a rechargeable power cell and a recharging interface. An external programmer is removably interfaced to the removable ear plug via the programming channel and the recharging interface to recharge the rechargeable power cell.

A further embodiment provides a method for providing a programmable audible alarm through an electronic ear plug. An electronic ear plug is situated relative to a programming interface removably disposed on an external programmer. The electronic ear plug includes a removable ear plug shaped on a distal end to be received by an ear and integrates an audible alarm circuit on a proximal end. A user-settable time interval is programmed via the programming interface and at least one programmable alarm tone is specified into a memory maintained in the electronic ear plug. The electronic ear plug is placed in an ear. The audible alarm circuit commences timing upon activation of the user-settable time interval and generates at least one programmable alarm tone responsive to an expiry of the user-settable time interval.

Still other embodiments of the present invention will become readily apparent to those skilled in the art from the following detailed description,

wherein are described embodiments of the invention by way of illustrating the best mode contemplated for carrying out the invention. As will be realized, the invention is capable of other and different embodiments and its several details are capable of modifications in various obvious respects, all without departing from the spirit and the scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

### **Brief Description of the Drawings**

FIGURES 1A-B are plan diagrams respectively showing a front view and a side view of an electronic ear plug for providing a programmable audible alarm, in accordance with the present invention.

FIGURES 2A-B are plan diagrams respectively showing a side view and a top view of a carrying case for the electronic ear plug of FIGURES 1A-B.

FIGURE 3 is a cut-away diagram showing a side cross-sectional view of the carrying case of FIGURES 2A-B.

FIGURE 4 is a schematic block diagram of the electronic ear plug of FIGURES 1A-B.

FIGURE 5 is a schematic block diagram of the carrying case of FIGURES 2A-B.

### **Detailed Description**

FIGURES 1A-B are plan diagrams respectively showing a front view and a side view of an electronic ear plug 11 for providing a programmable audible alarm, in accordance with the present invention. The electronic ear plug incorporates an electronic countdown timer coupled to a sonic transducer (not shown) that emits audible alarm tones, as further described below with reference to FIGURE 4. The electronic ear plug 11 is preferably shaped to fit directly into the ear canal and includes speaker perforations 12 on a distal end facilitating playback of the audible alarm tones. A set of electrical connectors 14A-B on a proximal end facilitate external battery recharging and alarm programming via a carrying case, as further described below with reference to FIGURES 2A-B.

In the described embodiment, the electronic ear plug 11 is soft-coated and shaped to fit directly into the ear canal in the same manner as a conventional ear plug. Alternatively, the electronic ear plug 11 could be shaped to fit conformably into the cavum conchae of the outer ear. The electronic ear plug 11 could be used  
5 singly or paired with another electronic ear plug 11. Other shapes and configurations of the electronic ear plug 11 are feasible, as would be recognized by one skilled in the art.

FIGURES 2A-B are plan diagrams respectively showing a side view 20 and a top view 30 of a carrying case 21 for the electronic ear plug 11 of  
10 FIGURES 1A-B. The carrying case 21 includes a removable cover 22 that preferably snaps into place. The electronic ear plug 11 can be programmed to playback audible alarm tones, including conventional buzzers, bells, voices, music, or other electronically-reproducible sounds. The user enters an alarm time on a keypad 23, which is displayed on a display 24. In the described embodiment,  
15 the alarm time is programmed as either an absolute wakeup time, such as 7:30AM, or as a relative wake up time, for instance, occurring 90 minutes from the present time. Other forms of programming inputs and sources, including interfacing to an external input source, such as a personal computer or cellular telephone, are feasible, as would be recognized by one skilled in the art.

20 The carrying case 21 also includes a pair of conformal recesses 26A-B for storing each electronic ear plug 11. Each conformal recess 26A-B includes a set of electrical connectors 27A-B that form an electrical connection with the set of connectors 14A-B (shown in FIGURE 1A) when each electronic ear plug 11 is placed in the carrying case 21. The electronic connection is used to recharge and  
25 program each electronic ear plug 11. Recharging activity is indicated by a charging light emitting diode (LED) 25 located next to the keypad 23.

FIGURE 3 is a cut-away diagram showing a side cross-sectional view 35 of the carrying case 21 of FIGURES 2A-B. The carrying case 21 incorporates programming circuitry 31 used to recharge and program each electronic ear plug  
30 11. A set of batteries 28 are received in a battery housing 29 for providing power to the programming circuitry 31.

FIGURE 4 is a schematic block diagram 40 of the electronic ear plug 11 of FIGURES 1A-B. Timer operation is controlled by a clock circuit 41, that includes an internal timer 42 and memory 43 powered by an electrical storage device, such as a super capacitor 45 or rechargeable battery (not shown). The memory 43 stores timer values and the audible alarm tones. The clock circuit 41 is connected to a transducer 44 that generates audible alarm tones. The super capacitor 45 receives a charge from the carrying case 21 (shown in FIGURES 2A-B) via charging connectors 46A-B. The clock circuit 41 receives programming signals from the carrying case 21 via connectors 47A-B. In the described embodiment, the charging connectors 46A-B and the programming connectors 47A-B would be merged into the pair of electrical connectors 14A-B (shown in FIGURE 1) to deliver charging and signaling on a single pair of wires, as is known in the art. Finally, the clock circuit 41 can also store audible alarm tones downloaded from the carrying case 21 in the memory 42. Other clock circuit configurations are feasible, as would be recognized by one skilled in the art.

FIGURE 5 is a schematic block diagram 50 of the carrying case 21 of FIGURES 2A-B. Recharging and programming is controlled by a clock control circuit 51, that includes a memory 52 powered by an electrical storage device, such as a removable battery 56 or external power source (not shown). The memory 52 stores downloadable timer values and audible alarm tones. The clock control circuit 51 receives programming inputs from a user from the keypad 55 and displays specified timer values on the display 53. The clock control circuit 51 also indicates charging activity on the LED 54. The clock control circuit 51 delivers a charge to each electronic ear plug 11 (shown in FIGURES 1A-B) via connectors 57A-B. Finally, the clock control circuit 51 sends programming signals and downloads audible alarm tones stored in the memory 52 via connectors 58A-B. In the described embodiment, the charging connectors 57A-B and the programming connectors 58A-B would be merged into the set of electrical connectors 27A-B (shown in FIGURE 2B) to deliver charging and signaling on a single pair of wires, as is known in the art.

The electronic ear plugs 11 can be used singly or in pairs. Operationally, to use the electronic ear plugs 11, a user first places the electronic ear plugs 11 in the carrying case 21 and uses the keypad 23 to program timer values. After setting a wakeup or alert time, the user places the electronic ear plugs 11 in one or  
5 both ears. The electronic ear plugs 11 sound an alarm at the programmed time.

Although the described embodiment incorporates a carrying case 21 that also serves as a recharging and programming device, alternative devices and adapters could be used. For example, a mobile telephone adapter could incorporate a telephone keypad display and provide electric power to recharge  
10 and program the electronic ear plugs 11. Also, the electronic ear plugs 11 could include built-in programming input control and logic in addition to the carrying case 21. Finally, the carrying case 21 could recharge each electronic ear plug super capacitor 45 using induction or disposable batteries could be employed.

While the invention has been particularly shown and described as  
15 referenced to the embodiments thereof, those skilled in the art will understand that the foregoing and other changes in form and detail may be made therein without departing from the spirit and scope of the invention.